REMARKS

Summary of the Amendment

Upon entry of the above amendment, the specification and drawings will have been amended. Additionally, claims 1-4 will have been canceled and claims 5-27 will have been added. Accordingly, claims 5-27 will be pending, with claims 5, 17 and 26 being in independent form.

Summary of the Official Action

In the Office action, the Examiner objected to the drawings and the specification. The Examiner also objected to claim 1. Finally, the Examiner rejected claims 1-4 over the applied art of record. By the present amendment and remarks, Applicant submits that the objections and rejections have been overcome, and respectfully requests reconsideration of the outstanding Office Action and allowance of the present application.

Objection to the drawings is moot

The Examiner objected to the drawings because Fig. 2 lacks a bracket.

Applicant is herein submitting an amended Fig. 2 illustrating a bracket.

Accordingly, the objection is believed to be rendered moot and the Examiner is requested to withdraw this objection.

Objections to the specification is moot

The Examiner objected to the disclosure because it was not arranged in a manner which is consistent with current USPTO rules.

By this amendment, it is believed that this issue has been addressed. Specifically, Applicant has herein amended the specification consistent with current USPTO rules.

Accordingly, the objection is believed to be rendered moot and the Examiner is requested to withdraw this objection.

Objections to the claims is moot

The Examiner objected to claim 1 because it recited both a broad range and a narrow range and because it recites an unclear limitation.

Applicant respectfully disagrees that certain language pointed out by the Examiner is properly characterized as a broad range within a narrow range.

Nevertheless, Applicant submits that this objection is moot inasmuch as claim 1 has been canceled in favor of new claims which are believed to fully comply with current USPTO rules.

Accordingly, the objection is believed to be rendered moot and the Examiner is requested to withdraw this objection.

Traversal of Rejections Under 35 U.S.C. § 103(a)

Applicant respectfully traverses the rejection of claims 1 and 2 under 35 U.S.C. § 103(a) as unpatentable over US Patent 5,866,853 to SHEEHAN in view of US Patent 3,980,325 to ROBERTSON.

Applicant also respectfully traverses the rejection of claims 3 and 4 under 35 U.S.C. § 103(a) as unpatentable over US Patent 5,866,853 to SHEEHAN in view of US Patent 3,980,325 to ROBERTSON, and further in view of US Patent 4,250,348 to KITAGAWA.

With regard to the former rejection, the Examiner asserted that SHEEHAN fairly discloses all of the claimed features recited in these claims except for a sleeve which includes nut strips. However, the Examiner asserted that ROBERTSON discloses a sleeve with nut strips and that it would have been obvious to modify the device of SHEEHAN in view of the teachings of ROBERTSON. Applicant respectfully traverses this rejection.

With regard to the latter rejection, the Examiner asserted that SHEEHAN and ROBERTSON fairly discloses all of the claimed features recited in these claims except for a tubular packing seal. However, the Examiner asserted that KITAGAWA discloses a tubular packing seal and that it would have been obvious to modify the device of SHEEHAN/ROBERTSON in view of the teachings of KITAGAWA. Applicant respectfully traverses this rejection.

Notwithstanding the Office Action assertions as to what these documents disclose or suggest, Applicant submits that no proper combination of the above-noted documents discloses or suggests, inter alia, a coupling bushing comprising external threads, first nut strips which extend axially beyond the external threads, and *a first internal pressure surface,* a covering nut comprising *a second internal pressure surface configured to engage and deform ends of the first nut strips radially indwardly and towards the cylindrical element when the cylindrical element is introduced into the coupling bushing and the covering nut*, and a sleeve comprising *second nut strips and an external diameter which is at most equal to an internal diameter of the coupling bushing*, whereby the sleeve, with the second nut strips being introduced first, is adapted to be introduced into the coupling bushing, wherein *the first internal pressure surface is configured to engage and deform ends of the second nut strips radially indwardly and towards the cylindrical element when the cylindrical element is introduced into the coupling bushing and the covering nut,* as recited in new independent claim 5, inter alia, a coupling bushing comprising external threads, first strips which extend axially from one end of the coupling bushing, and *a first internal tapered pressure surface*, a nut comprising internal threads and *a second internal tapered pressure surface configured to engage and deform ends of the first strips radially indwardly*, the internal threads of the nut being configured to threadably engage the external threads of the coupling bushing, a sleeve comprising *second strips which extend axially from one end of the sleeve*, and the

sleeve being configured to slide within the coupling bushing, wherein *the first internal tapered pressure surface is configured to engage and deform ends of the second strips radially indwardly when the nut moves towards the coupling bushing*, as recited in independent claim 17, and inter alia, a coupling bushing comprising external threads, first strips which extend axially from one end of the coupling bushing, and *a first internal tapered pressure surface*, a nut comprising internal threads and *a second internal tapered pressure surface configured to engage and deform ends of the first strips radially indwardly*, the internal threads of the nut being configured to threadably engage the external threads of the coupling bushing, a sleeve comprising *second strips which extend axially from one end of the sleeve*, the sleeve being configured to slide within the coupling bushing, and *a tubular packing seal adapted to be inserted partially into the sleeve and the coupling bushing*, wherein *the first internal tapered pressure surface is configured to engage and deform ends of the second strips radially indwardly when the nut moves towards the coupling bushing*, as recited in independent claim 26.

Applicant acknowledges that SHEEHAN relates to an electrical conduit connector as well as the Examiner's assertion that Fig. 5 of SHEEHAN discloses a coupling bushing 119 with nut strips 151 and a nut 162 with a pressure surface 160. However, it is clear from a fair review of Fig. 5 that SHEEHAN fails to disclose or suggest a coupling bushing which includes external threads, first nut strips which extend axially beyond the external threads,

and *a first internal pressure surface* wherein *the first internal pressure surface is configured to engage and deform ends of the second nut strips radially indwardly and towards the cylindrical element when the cylindrical element is introduced into the coupling bushing and the covering nut.* To the contrary, it is clear from Fig. 5 that the coupling bushing 119 lacks any internal pressure surface, much less, one that *is configured to engage and deform ends of the second nut strips radially indwardly.* Additionally, as acknowledged by the Examiner, this document clearly lacks any disclosure to a sleeve comprising *second nut strips and an external diameter which is at most equal to an internal diameter of the coupling bushing,* whereby the sleeve, with the second nut strips being introduced first, is adapted to be introduced into the coupling bushing.

It is also clear that SHEEHAN fails to disclose or suggest a coupling bushing comprising external threads, first strips which extend axially from one end of the coupling bushing, and *a first internal tapered pressure surface*, wherein *the first internal tapered pressure surface is configured to engage and deform ends of the second strips radially indwardly when the nut moves towards the coupling bushing.* Additionally, the Examiner has acknowledged that this document lacks any disclosure with regard to either a sleeve comprising *second strips which extend axially from one end of the sleeve*, and the sleeve being configured to slide within the coupling bushing, or *a tubular packing seal adapted to be inserted partially into the sleeve and the coupling bushing.*

Applicant acknowledges the Examiner's opinion that ROBERTSON apparently discloses a sleeve 12 with strips (see Fig. 6). However, it is apparent that this document relates to a fitting for a plastic pipe which is used for an underground lawn sprinkling system (see col. 1, lines 10-13). Thus, the Examiner must acknowledge the instant rejection is based upon the combination of a pipe fitting and an electrical connector system - items which are entirely unrelated to one another. Applicant submits that, contrary to the Examiner's assertions, it would not have been obvious to one of ordinary skill in the art to use a pipe fitting sleeve from a sprinkler system as taught by ROBERTSON on the electrical conduit connector of SHEEHAN.

Applicant further notes that ROBERTSON also fails to disclose or suggest a coupling bushing which includes external threads, first nut strips which extend axially beyond the external threads, and *a first internal pressure surface* wherein *the first internal pressure surface is configured to engage and deform ends of the second nut strips radially indwardly and towards the cylindrical element when the cylindrical element is introduced into the coupling bushing and the covering nut.* To the contrary, it is clear from Fig. 5 that bushing 10 is entirely lacking in nut strips and in an internal pressure surface. Nor does this document disclose or suggest a covering nut comprising *a second internal pressure surface configured to engage and deform ends of the first nut strips radially indwardly and towards the cylindrical element when the cylindrical element is introduced into the coupling bushing*

and the covering nut. Finally, this document clearly lacks any disclosure to a sleeve comprising *second nut strips and an external diameter which is at most equal to an internal diameter of the coupling bushing*, whereby the sleeve, with the second nut strips being introduced first, is adapted to be introduced into the coupling bushing. To the contrary, Fig. 7 shows that the sleeve 12 slides over the bushing 10 and, thus, the sleeve 12 clearly lacks *an external diameter which is at most equal to an internal diameter of the coupling bushing.*

It is also clear that ROBERTSON fails to disclose or suggest a coupling bushing comprising external threads, first strips which extend axially from one end of the coupling bushing, and *a first internal tapered pressure surface*, wherein *the first internal tapered pressure surface is configured to engage and deform ends of the second strips radially indwardly when the nut moves towards the coupling bushing.* Again, it is clear from Fig. 5 that bushing 10 is entirely lacking in nut strips and in an internal pressure surface. Nor does this document disclose or suggest a nut comprising internal threads and *a second internal tapered pressure surface configured to engage and deform ends of the first strips radially indwardly*, the internal threads of the nut being configured to threadably engage the external threads of the coupling bushing. Finally, this document lacks any disclosure with regard to either a sleeve comprising *second strips which extend axially from one end of the sleeve*, and the sleeve being configured to slide within the coupling bushing, or *a tubular packing seal adapted to be inserted partially into the sleeve and the coupling bushing.* Again, Fig. 7

shows that the sleeve 12 slides over the bushing 10 and, thus, the sleeve 12 clearly is not configured to slide within the coupling bushing.

Applicant also acknowledges that KITAGAWA relates to a clamping device for cables and the Examiner's assertion that KITAGAWA discloses a tubular packing seal 11. However, it is clear from a fair review of Figs. 5 and 6 that KITAGAWA fails to disclose or suggest a coupling bushing which includes external threads, first nut strips which extend axially beyond the external threads, and *a first internal pressure surface* wherein *the first internal pressure surface is configured to engage and deform ends of the second nut strips radially indwardly and towards the cylindrical element when the cylindrical element is introduced into the coupling bushing and the covering nut.* To the contrary, pressure surface 6 is merely a groove which receives the packing seal 11 during deformation (see col. 3, lines 38-39). Additionally, this document clearly lacks any disclosure to a sleeve, much less, one which comprises *second nut strips and an external diameter which is at most equal to an internal diameter of the coupling bushing*, whereby the sleeve, with the second nut strips being introduced first, is adapted to be introduced into the coupling bushing.

It is also clear that KITAGAWA fails to disclose or suggest a coupling bushing comprising external threads, first strips which extend axially from one end of the coupling bushing, and *a first internal tapered pressure surface*, wherein *the first internal tapered pressure surface is configured to engage and deform ends of the second strips radially*

indwardly when the nut moves towards the coupling bushing. Again, pressure surface 6 is merely a groove which receives the packing seal 11 during deformation (see col. 3, lines 38-39). It is also clear that this document lacks any disclosure with regard to a sleeve, much less, one comprising *second strips which extend axially from one end of the sleeve*, and the sleeve being configured to slide within the coupling bushing. Nor can it be properly said that, absent any type of sleeve, the packing seal 11 is *adapted to be inserted partially into the sleeve and the coupling bushing*.

By way of background, the invention provides for a device in which two sets of oppositely arranged strips 9 and 10 are engaged and deformed inwardly by two internal pressure surfaces 11 and 12 in order to provide for two point compression of the cylindrical element or cable 1. In contrast to the instant invention, the applied documents do not suggest a device which increases the two point compression of the cylindrical element with two sets of strips and two internal pressure surfaces as the nut is brought closer to the coupling bushing.

Thus, Applicant submits that the above-noted document fails to disclose or suggest the features recited in at least independent claims 5, 17 and 26. Because no proper combination of SHEEHAN, ROBERTSON and KITAGAWA discloses or suggests at least the above-noted features of the instant invention, Applicant submits that no proper combination or modification of these documents can render unpatentable the combination

of features recited in at least independent claims 5, 17 and 26.

Furthermore, Applicant submits that there is no motivation or rationale disclosed or suggested in the art to modify any of the applied documents in the manner asserted by the Examiner. Nor does the Examiner's opinion provide a proper basis for these features or for the motivation to modify these documents, in the manner suggested by the Examiner. Therefore, Applicant submits that the invention as recited in at least independent claims 5, 17 and 26 is not rendered obvious by any reasonable inspection of these disclosures.

Applicant directs the Examiner's attention to the guidelines identified in M.P.E.P section 2141 which state that "[i]n determining the propriety of the Patent Office case for obviousness in the first instance, it is necessary to ascertain whether or not the reference teachings would appear to be sufficient for one of ordinary skill in the relevant art having the reference before him to make the proposed substitution, combination, or other modification." *In re Linter*, 458 F.2d 1013, 1016, 173 USPQ 560, 562 (CCPA 1972).

As this section clearly indicates, "[o]bviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992)."

Moreover, it has been legally established that "[t]he mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990) .... Although a prior art device "may be capable of being modified to run the way the apparatus is claimed, there must be a suggestion or motivation in the reference to do so." 916 F.2d at 682, 16 USPQ2d at 1432.). See also *In re Fritch*, 972 F.2d 1260, 23 USPQ2d 1780 (Fed. Cir. 1992) (flexible landscape edging device which is conformable to a ground surface of varying slope not suggested by combination of prior art references).

Additionally, it has been held that "[a] statement that modifications of the prior art to meet the claimed invention would have been "` well within the ordinary skill of the art at the time the claimed invention was made"' because the references relied upon teach that all aspects of the claimed invention were individually known in the art is not sufficient to establish a prima facie case of obviousness without some objective reason to combine the teachings of the references. *Ex parte Levengood*, 28 USPQ2d 1300 (Bd. Pat. App. & Inter. 1993)."

Furthermore, Applicant submits that dependent claims 6-16, 18-25 and 27 are allowable at least for the reason that these claims depend from allowable base claims and because these claims recite additional features that further define the present invention. In particular, Applicant submits that no proper combination of SHEEHAN, ROBERTSON and

KITAGAWA discloses or suggests, in combination: that the cylindrical element comprises a cable as recited in claim 6; that the first and second internal pressure surfaces are configured to cause the first and second nut strips to be anchored in the cylindrical element when the covering nut is tightened as recited in claim 7; that the first and second internal pressure surfaces comprise tapered surfaces as recited in claim 8; that the first and second internal pressure surfaces comprise tapered surfaces which face in opposite directions as recited in claim 9; that the device further comprises a tubular packing seal adapted to be inserted in, a final assembled position, between the cylindrical element and the sleeve as recited in claim 10; that the device further comprises a tubular packing seal adapted to be inserted in, a final assembled position, between the cylindrical element and the first nut strips as recited in claim 11; that the device further comprises a packing seal adapted to slide over the cylindrical element and into the sleeve as recited in claim 12; that the packing seal comprises a first part having a first external diameter and a second part having a different second external diameter as recited in claim 13; that the first diameter is smaller than the second diameter, wherein the first diameter corresponds substantially to an internal diameter of the sleeve, and wherein the second diameter corresponds substantially to the internal diameter of the coupling bushing as recited in claim 14; that the covering nut comprises internal threads configured to threadably engage the external threads of the coupling bushing as recited in claim 15; a method of fixing the cylindrical element using the device of claim

5, wherein the method comprises arranging the coupling bushing on the cylindrical element with the first nut strips facing in a first direction, arranging the sleeve on the cylindrical element with the second nut strips facing in a second opposite direction, arranging the covering nut on the cylindrical element, moving the covering nut towards the coupling bushing, engaging and deforming ends of the second nut strips radially indwardly with the first internal pressure surface by moving the covering nut towards the coupling bushing, threadably engaging internal threads of the covering nut and the external threads of the coupling bushing, and engaging and deforming ends of the first nut strips radially indwardly with the second internal pressure surface by moving the covering nut further towards the coupling bushing as recited in claim 16; that the first and second internal tapered pressure surfaces are configured to cause the first and second strips to be anchored in the cable when the nut is tightened onto the coupling bushing as recited in claim 18; that the first and second internal tapered pressure surfaces face in opposite directions as recited in claim 19; that the device further comprises a tubular packing seal adapted to be inserted between the cable and the sleeve as recited in claim 20; that the device further comprises a tubular packing seal adapted to be inserted between the cable and the first strips as recited in claim 21; that the device further comprises a packing seal adapted to slide over the cable and into the sleeve as recited in claim 22; that the packing seal comprises a first part having a first external diameter and a second part having a different second external diameter as recited in claim

23; that the first diameter is smaller than the second diameter, wherein the first diameter corresponds substantially to an internal diameter of the sleeve, and wherein the second diameter corresponds substantially to the internal diameter of the coupling bushing as recited in claim 24; a method of fixing a cable to a plug or a socket using the device of claim 17, wherein the method comprises arranging the coupling bushing on the cable with the first strips facing in a first direction, arranging the sleeve on the cable with the second strips facing in a second opposite direction, arranging the nut on the cable, moving the nut towards the coupling bushing, engaging and deforming ends of the second strips radially indwardly with the first internal tapered pressure surface by moving the nut towards the coupling bushing, threadably engaging the internal threads of the nut and the external threads of the coupling bushing, and engaging and deforming ends of the first strips radially indwardly with the second internal tapered pressure surface by moving the nut further towards the coupling bushing as recited in claim 25; a method of fixing a cable to a plug or a socket using the device of claim 26, wherein the method comprises arranging the coupling bushing on the cable with the first strips facing in a first direction, arranging the sleeve on the cable with the second strips facing in a second opposite direction, arranging the tubular packing seal on the cable, arranging the nut on the cable, moving the nut towards the packing seal until the second internal tapered surface engages the packing seal, causing the sleeve and the packing seal to slide into the coupling bushing, moving the nut towards the coupling bushing,

engaging and deforming ends of the second strips radially indwardly with the first internal tapered pressure surface by moving the nut and the packing seal towards the coupling bushing, threadably engaging the internal threads of the nut and the external threads of the coupling bushing, and engaging and deforming ends of the first strips radially indwardly with the second internal tapered pressure surface by moving the nut further towards the coupling bushing as recited in claim 27.

Accordingly, Applicant requests that the Examiner reconsider and withdraw the above-noted rejection under 35 U.S.C. § 103(a) and indicate that these claims are allowable over the applied art of record.

CONCLUSION

Applicant respectfully submits that each and every pending claim of the present invention meets the requirements for patentability under 35 U.S.C. § § 112, 102 and 103 and respectfully requests the Examiner to indicate allowance of each and every pending claim of the present invention.

In view of the foregoing, it is submitted that none of the references of record, either taken alone or in any proper combination thereof, anticipate or render obvious Applicant's invention, as recited in each of claims 5-27. The applied references of record have been discussed and distinguished, while significant claimed features of the present invention have

been pointed out.

Further, any amendments to the claims which have been made in this response and which have not been specifically noted to overcome a rejection based upon the prior art, should be considered to have been made for a purpose unrelated to patentability, and no estoppel should be deemed to attach thereto.

The Commissioner is hereby authorized to charge any fees necessary for consideration of this amendment to deposit account No. 19-0089.

Should there be any questions, the Examiner is invited to contact the undersigned attorney at the number listed below.

Respectfully submitted,
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PATENT & TRADEMARK

AXIAL MAINTENANCE DEVICE FOR A CYLINDRICAL ELEMENT AND IN PARTICULAR A CABLE

Do not Enter 12/22/03

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application is a National Stage Application of International Application No. PCT/FR01/02248, filed July 12, 2001. Further, the present application claims priority under 35 U.S.C. § 119 of French Patent Application No. 00/09608 filed on July 21, 2000.

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BACKGROUND OF THE INVENTION

1. Field of the Invention

[0002] The present invention relates to a device for axial maintenance of a cylindrical element and more particularly a cable.

2. Discussion of Background Information

[0003] For fixing a cylindrical element into another element, such as for example, an electric cable into the coupling bushing of a plug or electricity socket, or furthermore, for example, into a conduit, a tube or pipe in an apparatus or accessory, it is known how to use devices which maintain said cylindrical element against traction efforts.

[0004] For this, a device for axial maintenance is known comprising an axial maintenance device for a cylindrical element and more particularly for a cable, comprising a coupling bushing which is threaded externally and which is prolonged in the axial direction by tightening nut strips, and a covering nut comprising internally a reduced pressure surface intended to act on the ends of the nut strips of the coupling bushing and to deform them radially towards the cylindrical element previously introduced into said coupling bushing after crossing said nut.

[0005] This type of device is, for example, described in the French patent 2358766 or again in the European patent 0381980.

[0006] In the French patent cited above, the device furthermore comprises a packing

seal and thus constitutes both a compression gland or stuffing box.

[0007] In this device known in prior art, the packing deforms into a truncated cone and the adhesion of the cable is active over a limited length.

[0008] Furthermore, the deformation of the packing is not well contained internally and each device can only concern a restricted number of elements to fix, in a relatively reduced range of diameters.

[0009] Finally, in such a device, there cannot be any strip anchoring in the element to be held since any traction on the latter tends to separate said strips.

SUMMARY OF THE INVENTION

[0010] Among other things, the invention makes it possible to improve the traction resistance performances of this type of device, especially in order to fulfil the anti-deflagration standards relative to the domain of electrical apparatuses.

[0011] In order to do this, a device according to the invention of the type described above is particularly notable in that it further comprises a sleeve also provided with nut strips and whose external diameter is at most equal to the internal diameter of the coupling bushing in which said sleeve is intended to be introduced beginning by said strips with which it is provided~~, said~~ . The coupling bushing ~~being~~ is further provided internally with a reduced pressure surface, which is intended to act on the nut strips of the sleeve.

[0012] According to an embodiment, the pressure surface of the coupling bushing and the sleeve are dimensioned so that the strips of said sleeve anchor into the cylindrical element during the tightening of the nut.

[0013] In order to ensure tightness, the invention envisages an embodiment which is provided with a tubular sealing packing intended to be inserted in final position between the cylindrical element, the sleeve and the coupling bushing strips.

[0014] For example, in this case, the sealing packing is in two parts of different external diameters, the smallest external diameter corresponding substantially to the internal

diameter of the sleeve and the biggest diameter corresponding substantially to the internal diameter of the coupling bushing.

[0015] A device according to the invention which remains compact and which only requires a single screwing operation also makes it possible to ensure, with a single device, both the anchoring and the sealing of various cables in a large range of diameters, which simplifies the choice of the user, limits storage problems and raises manufacturing volumes, thus reducing production costs.

[0016] The invention also provides for a device for axial maintenance of a cylindrical element, wherein the device comprises a coupling bushing comprising external threads, first nut strips which extend axially beyond the external threads, and a first internal pressure surface. A covering nut is provided which comprises a second internal pressure surface configured to engage and deform ends of the first nut strips radially inwardly and towards the cylindrical element when the cylindrical element is introduced into the coupling bushing and the covering nut. A sleeve is also provided which comprises second nut strips and an external diameter which is at most equal to an internal diameter of the coupling bushing, whereby the sleeve, with the second nut strips being introduced first, is adapted to be introduced into the coupling bushing. The first internal pressure surface is configured to engage and deform ends of the second nut strips radially inwardly and towards the cylindrical element when the cylindrical element is introduced into the coupling bushing and the covering nut.

[0017] The cylindrical element may comprise a cable. The first and second internal pressure surfaces may be configured to cause the first and second nut strips to be anchored in the cylindrical element when the covering nut is tightened. The first and second internal pressure surfaces may comprise tapered surfaces. The first and second internal pressure surfaces may comprise tapered surfaces which face in opposite directions.

[0018] The device may further comprise a tubular packing seal adapted to be inserted

in, a final assembled position, between the cylindrical element and the sleeve. The device may further comprise a tubular packing seal adapted to be inserted in, a final assembled position, between the cylindrical element and the first nut strips. The device may further comprise a packing seal adapted to slide over the cylindrical element and into the sleeve. The packing seal mat comprise a first part having a first external diameter and a second part having a different second external diameter. The first diameter may be smaller than the second diameter, wherein the first diameter corresponds substantially to an internal diameter of the sleeve, and wherein the second diameter corresponds substantially to the internal diameter of the coupling bushing.

[0019] The covering nut may comprise internal threads configured to threadably engage the external threads of the coupling bushing.

[0020] The invention also provides for a method of fixing the cylindrical element using the device described above, wherein the method comprises arranging the coupling bushing on the cylindrical element with the first nut strips facing in a first direction, arranging the sleeve on the cylindrical element with the second nut strips facing in a second opposite direction, arranging the covering nut on the cylindrical element, moving the covering nut towards the coupling bushing, engaging and deforming ends of the second nut strips radially inwardly with the first internal pressure surface by moving the covering nut towards the coupling bushing, threadably engaging internal threads of the covering nut and the external threads of the coupling bushing, and engaging and deforming ends of the first nut strips radially inwardly with the second internal pressure surface by moving the covering nut further towards the coupling bushing.

[0021] The invention also provides for a device for fixing a cable to a plug or a socket, wherein the device comprises a coupling bushing comprising external threads, first strips which extend axially from one end of the coupling bushing, and a first internal tapered pressure surface. A nut is provided which comprises internal threads and a second internal

tapered pressure surface configured to engage and deform ends of the first strips radially inwardly. The internal threads of the nut are configured to threadably engage the external threads of the coupling bushing. A sleeve is provided which comprises second strips which extend axially from one end of the sleeve. The sleeve is configured to slide within the coupling bushing. The first internal tapered pressure surface is configured to engage and deform ends of the second strips radially inwardly when the nut moves towards the coupling bushing.

[0022] The first and second internal tapered pressure surfaces may be configured to cause the first and second strips to be anchored in the cable when the nut is tightened onto the coupling bushing. The first and second internal tapered pressure surfaces may face in opposite directions.

[0022] The device may further comprise a tubular packing seal adapted to be inserted between the cable and the sleeve. The device may further comprise a tubular packing seal adapted to be inserted between the cable and the first strips. The device may further comprise a packing seal adapted to slide over the cable and into the sleeve. The packing seal may comprise a first part having a first external diameter and a second part having a different second external diameter. The first diameter may be smaller than the second diameter, wherein the first diameter corresponds substantially to an internal diameter of the sleeve, and wherein the second diameter corresponds substantially to the internal diameter of the coupling bushing.

[0023] The invention also provides for a method of fixing a cable to a plug or a socket using the device described above, wherein the method comprises arranging the coupling bushing on the cable with the first strips facing in a first direction, arranging the sleeve on the cable with the second strips facing in a second opposite direction, arranging the nut on the cable, moving the nut towards the coupling bushing, engaging and deforming ends of the second strips radially inwardly with the first internal tapered pressure surface by moving the

nut towards the coupling bushing, threadably engaging the internal threads of the nut and the external threads of the coupling bushing, and engaging and deforming ends of the first strips radially inwardly with the second internal tapered pressure surface by moving the nut further towards the coupling bushing.

[0024] The invention also provides for a device for fixing a cable to a plug or a socket, wherein the device comprises a coupling bushing comprising external threads, first strips which extend axially from one end of the coupling bushing, and a first internal tapered pressure surface. A nut comprises internal threads and a second internal tapered pressure surface configured to engage and deform ends of the first strips radially inwardly. The internal threads of the nut is configured to threadably engage the external threads of the coupling bushing. A sleeve comprises second strips which extend axially from one end of the sleeve. The sleeve is configured to slide within the coupling bushing. A tubular packing seal is adapted to be inserted partially into the sleeve and the coupling bushing. The first internal tapered pressure surface is configured to engage and deform ends of the second strips radially inwardly when the nut moves towards the coupling bushing.

[0025] The invention also provides for a method of fixing a cable to a plug or a socket using the device described above, wherein the method comprises arranging the coupling bushing on the cable with the first strips facing in a first direction, arranging the sleeve on the cable with the second strips facing in a second opposite direction, arranging the tubular packing seal on the cable, arranging the nut on the cable, moving the nut towards the packing seal until the second internal tapered surface engages the packing seal, causing the sleeve and the packing seal to slide into the coupling bushing, moving the nut towards the coupling bushing, engaging and deforming ends of the second strips radially inwardly with the first internal tapered pressure surface by moving the nut and the packing seal towards the coupling bushing, threadably engaging the internal threads of the nut and the external threads of the coupling bushing, and engaging and deforming ends of the first strips radially inwardly

with the second internal tapered pressure surface by moving the nut further towards the coupling bushing.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] The invention will be better understood and other particularities will become clear by reading the following description which refers to the attached drawings in which:

[[-]] figure 1 ~~is~~ shows an exploded view of a device according to the invention[[.]];

[[-]] figure 2 ~~is~~ shows an axial cross-section of the various elements to be assembled[[.]];

[[-]] figures 3, 4 and 5 ~~are~~ show axial cross-sections of the device of figures 1 and 2, respectively before screwing the nut, at the beginning of screwing and at the end of screwing[[.]]; and

[[-]] figure 6 ~~is~~ shows a view corresponding to figure 5 according to another very slightly different embodiment.

DETAILED DESCRIPTION OF THE INVENTION

[0027] The figures represent a device according to the invention intended to fix, in the example shown, an electric cable 1 (figures 3 to 6) in a bush 2 of an electrical connection ~~means~~ system (coupling bushing of a plug or mobile plug or of an extension or connector etc.)

[0028] The device according to the invention comprises a coupling bushing 3 integral with the bush 2, a sleeve 4, a packing seal 5 in rubber and a ring shaped nut 6.

[0029] As shown clearly in the diagrams, the coupling bushing 3 and the sleeve 4 are provided with a base 7 and a base 8 respectively, prolonged by strips 9 and 10 respectively which protrude externally in the axial direction~~, the~~ . The strips 10 of the sleeve 4 ~~being~~ are positioned for assembly, as explained below, towards the strips 9 of the coupling bushing 3 (figures 1 and 2). The base 7 of the coupling bushing 3 is further provided with an external threading as shown in the drawings[[,]]. This external threading is intended to co-operate

with the internal threading of the nut 6.

[0030] At the base of its threading, the nut 6 has an internal pressure surface 11 reduced, for example, in truncated form whose function will be explained below.

[0031] In the same way, the base of the coupling bushing 3 is, on the opposite side from the strips 9, provided with a reduced internal pressure surface 12.

[0032] As shown clearly in the drawings, the packing 5 has two parts 5a and 5b in steps of different external diameters.

[0033] The smallest external diameter (part 5a) of the packing 5 corresponds substantially to the internal diameter of the base 8 of the ~~coupling bushing 3~~ sleeve 4 and the biggest diameter (part 5b) corresponds substantially to the internal diameter of the strips 9 of the ~~sleeve 4~~ coupling bushing 3 before deformation, while the external diameter of said sleeve 4 is substantially equal to the internal diameter of the coupling bushing 3.

[0034] The drawings show clearly the way in which to assemble together the various elements of the device.

[0035] The elements are initially arranged as shown in figures 1 and 2.

[0036] Beginning from this assembly, the sleeve 4 is introduced by its strips into the coupling bushing 3, and after or before, the part 5a is introduced into the packing 5 in the base 8 of the sleeve 4 and the covering nut 6 is set in place on the strips 9 of the coupling bushing 3 in order to be in the position of figure 3.

[0037] Before or after this first assembly, the cable 1 is evidently introduced through all the elements (2, 3, 4, 5 and 6).

[0038] Starting from the position of figure 3, the nut 6 is pushed which itself pushes the packing assembly 5 and sleeve 4 until the strips 10 of the sleeve 4 are held radially by the pressure surface 12 of the coupling bushing 3 to be deformed and to be tightened onto the cable 1 as shown in figure 4.

[0039] Next the screwing of the nut 6 is carried out which accentuates the deformation

of the strips 10. By continuing said screwing of the nut 6, the strips 9 of the coupling bushing 3 tighten radially on the packing 5 by deforming under the effect of the pressure surface 11 of said nut 6.

[0040] In the embodiment of figures 1 to 5, the length of the sleeve 4 and the pressure surface 12 of the coupling bushing 3 are such that the strips 10 of said sleeve 4 are anchored at the end of screwing in the cable 1 as shown in figure 5.

[0041] In the embodiment of figure 6, the base 8 of the sleeve 4 is less long axially and/or the strips 10 are shorter as well as the pressure surface 12, in such a way that in this embodiment, said strips 10 do not anchor in the cable 1. Given that the differences of the sleeve and the surface 12 of the coupling bushing 3 of the device of figure 6, relative to the sleeve 4 and the coupling bushing 3 of figures 1 to 5 are essentially dimensional, the same references have been kept on said figures.

[0042] On figures 5 and 6, it can be seen that the packing 5 is perfectly compressed by the sleeve 4 and the strips 9 of the coupling bushing 3, and furthermore it is perfectly maintained between its two ends by the strips 9 and 10 of the coupling bushing 3 and the sleeve 4 respectively.

[0043] Compared to prior art, the invention enables a greater length of contact between the packing 5 and the cable 1 together with a greater volume of deformed packing, which increases the reliability of the sealing and retention, thus ensuring a greater reserve of elasticity to compensate for the relaxation of plastic parts intended to compress the packing.

[0044] The strips 9 of the coupling bushing 3 act on the packing 5 and the cable 1 in a classic way whereas the strips ~~9~~ 10 of the sleeve 4 act in the opposite direction with, further, an anchoring or not, in the cable 1 (figures 5 and 6 respectively).

[0045] Furthermore it can be understood that in the embodiment of figures 1 to 5, any traction on the cable accentuates the anchoring of the sleeve 4, said anchoring thus being self-blocking.

[0046] If the embodiment relates in particular to an electric cable, it can evidently concern, as explained above, any cylindrical element.